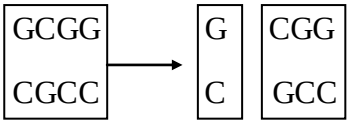
DNA is a VERY long molecule but the majority of the sequences are similar in all humans (since we are all the same species). Some sections, however, are quite unique to individuals like a "Fingerprint". We can cut DNA with special proteins called "Restriction Enzymes" that act like DNA scissors. There are many types of restriction enzymes that cut at specific sequence trigger points. By cutting DNA into pieces, we can see just how different or similar people are to each other. The closer the fragment pattern is the more related people are. This is how the methods of DNA paternity testing and forensic analysis work to match a person to a sample in question.

A. The Restriction Enzyme named "Hind III" will cut the DNA in between a G & C when the G is followed by CGG:

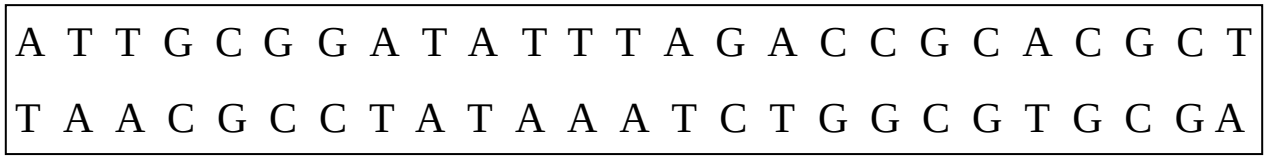


B. Cut out each complete sequence below. Next cut out the resulting fragments in the presence of the Hind III restriction enzyme.

C. Which two sequences are from the same person and how do you know?

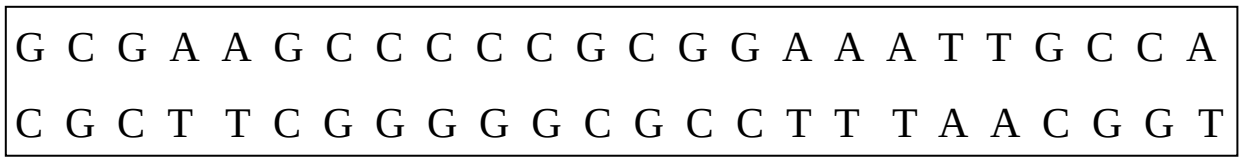
D. How many fragments are in each sequence and explain how the distance they will move is related to their relative size.

1. Direction to read top sequence

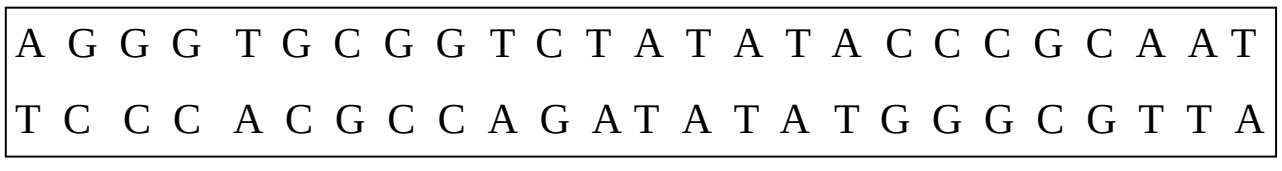


Direction to read bottom sequence

2.



3.



Analyzing the DNA using Gel Electrophoresis

Once we have samples of DNA which are cut into fragments, they can be sorted according to the size of their fragments.

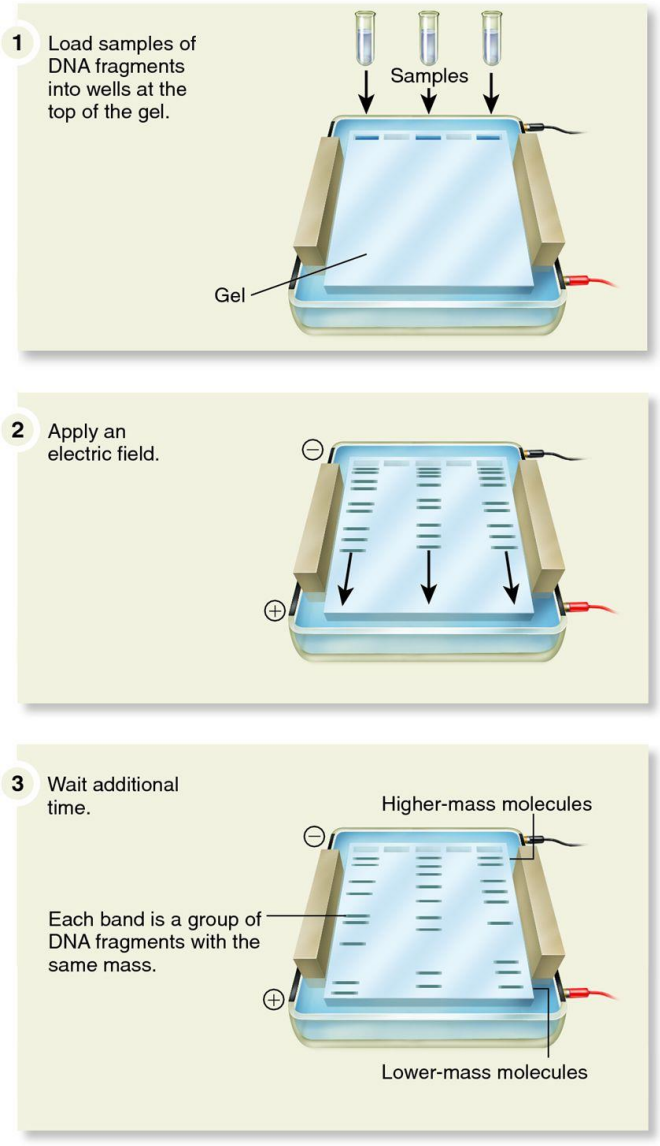
A gel called agarose has small pores in it that allow DNA to slowly move through it. Large fragments will move slowly since they are too big to easily slide through the pores. Small fragments will move fast.

DNA is negatively charged so it will begin moving away from current that is negatively charged and towards a current that is positively charged (opposites attract/same charges repel).

After a certain amount of time, the electricity is turned off and the DNA has been separated by the sizes of its fragments.

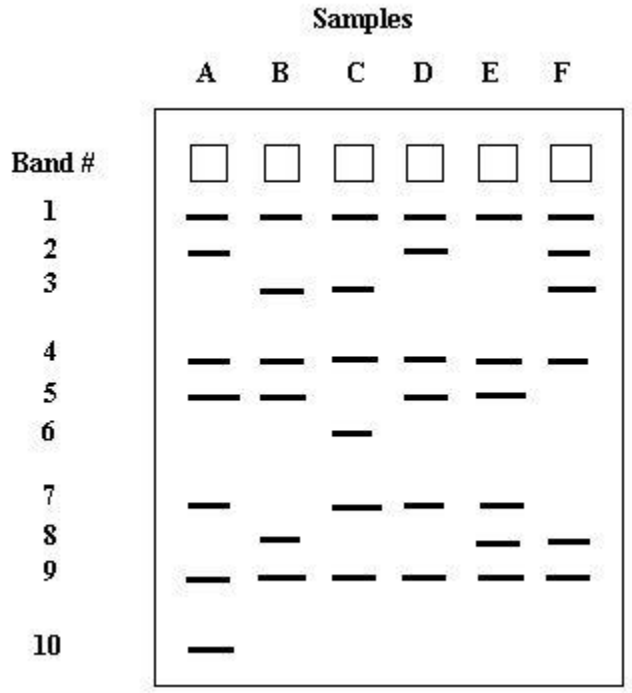
The results appear as "bands" in a column with each column representing an individual sample of DNA.

DNA is colorless, so usually you have to stain it after the gel is removed from the chamber.



Practice

Examine the diagram of an agarose gel below and answer the following questions.



- Which band(s) traveled slowest?
- Which band(s) traveled fastest?
- On the above drawing, label the positive and negative ends of the gel.
- Which bands are shared in common by **all** of the individuals?
- Are there any bands which are unique to only one individual? If so, which one?
- Which 2 samples are the most closely related and EXPLAIN your answer.